

TIRE INFLATION AND HANDLING ASSISTANCE DEVICE

BACKGROUND OF THE INVENTION

5 The present invention relates to an inflation and handling assistance device for inflatable tires, and particularly to shop equipment to facilitate efficient inflation and safer tire handling.

10 Standard tire replacement procedures include removal of a damaged or worn tire from a rim, followed by the mounting of a new tire onto the conserved rim. The machinery and methods for this step are known and include powered angular displacement tools which assist the walls of the tire into the depression between the inner and outer rim members.

15 Once the new tire is mounted in position within the rim walls the next step is the introduction of pressurized air in a manner cooperative with the sealing of the tire rim sealing areas against the radially outer, but inwardly facing areas of the rim walls. In many cases, the tire 20 facing walls in the uninflated state are close together creating a significant gap between one side of the tire walls and the space between the inner and outer rim members.

25 This gap, especially when the tire and rim assembly is resting on a flat surface, forms to one side and particularly resists engagement of the rim engagement

surface of the tire with the opposing inwardly facing area of the rim wall. For smaller tires a pneumatically activated belt or other assist can help with tire sealing. For larger, more stiff tires, the problem requires a different 5 solution. This assistance device works for smaller tires and can overcome the positional forces of having the tire and rim supported by a flat surface. However, larger tires, especially commercial truck tires, are generally too rigid to have the center of their treads forced inward to cause 10 flaring of the tire side walls.

The ground supported tire can be dangerous where a user attempts to lift and support the rim in an attempt to cause the tire to inflate as the hand can be caught between the rim and rim engagement surfaces of the new tire. Further, 15 for tires larger than small automobile tires, attempting to manipulate the tire on a flat surface is not only difficult and dangerous but also one of the worst positions from which to move the tire if inflation is achieved. A single worker must try to reach under the tire to simultaneously lift and 20 push it forward in order to keep a grip. This position is awkward and has a significant incidence of worker injury associated with it.

Even though the tire is lifted from one side, it is still an awkward dead lift. Where the floor surface is 25 slippery, and where the worker is strong lifting the tire

from the floor surface may be nearly impossible. A second worker may be required to stabilize the side of the tire which is supposed to be pivoted against the floor, and it may be advantageous to employ a special tool just to pry the 5 weight of the resting tire upward. Even if this is done as safely as possible with two workers, employee injury is still likely to result from prying and lifting a tire in opposition between two workers.

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SUMMARY OF THE INVENTION

A tire inflation and handling assistance device provides an adequately stabilized and supported vertical tire support member having a hub engagement and stop structure which can be pivoted from a first generally 15 horizontal position to an angled position of from about 50 degrees to about 75 degrees and more preferably from about 55 degrees to about 70 degrees and more preferably from about 60 degrees to about 65 degrees of displacement from a horizontal position to enable an uninflated hub and tire 20 assembly to be rolled to the tire inflation and handling assistance device, tilted to a position engaging the tire support member and then tilted to a horizontal position; as well as to enable a pressurizably inflated hub and tire assembly to be tilted from a horizontal position to a tilted 25 to a position engaging at or near the ground where it may be

further righted for further rolling handling and transport. Other work may be done on the hub and tire assembly utilizing the tire inflation and handling assistance device as a support.

5 The angle utilized may be dependent upon the shape and extent of engagement of the hub engagement and stop structure, with a more shallow hub engagement and stop structure preferably having a lesser tilt angle and a more linear "through engagement" hub engagement and stop structure enabling a greater magnitude tilt angle.

10 With the tire inflation and handling assistance device, a worker can roll an uninflated tire and rim assembly to a position adjacent the device and tilt it onto the hub engagement and stop structure where it engages the hub. The 15 uninflated tire and rim assembly is then tilted to a horizontal position in which the hub supports the tire to enable the bottom tire rim sealing areas to seat against the lower rim wall. Air can then be forcibly blown within the remaining opening to cause the tire to expand and seal 20 against the upper rim wall. After engagement, with some pressure, the tire is typically removed and taken to another location for full, safe inflation to an approved operating pressure. Once the tire is filled, the user can tilt the horizontally supported pressurized tire and rim assembly to 25 an angle which enables the tire to engage the ground so that

it can continue to be righted to a vertical position with much less effort than would be required to lift it upwardly from a horizontal surface. The device thus facilitates handling of the uninflated hub and tire assembly,
5 facilitates inflation of the hub and tire assembly, and further facilitates unloading of the inflated hub and tire assembly for easy movement by one worker.

The tire inflation and handling assistance device may be provided with a stand which disassembled to a stowable
10 configuration, or it may be mounted to be supported from a bracket or fitted opening attached to any other appropriate structure, especially where it is desired to minimize the floor footprint of the support, or where an easier and more complete stowage is desired.

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BRIEF DESCRIPTION OF THE DRAWINGS

The invention, its configuration, construction, and operation will be best further described in the following
20 detailed description, taken in conjunction with the accompanying drawings in which:

Figure 1 shows stand-alone tire inflation and handling assistance device;

Figure 2 is a side view, taken along line 2-2 of Figure
25 1 and illustrates in phantom the range of tilt of the tire

inflation and handling assistance device seen in Figure 1;

Figure 3 is a side sectional view taken through a hub and tire assembly supported by the tire inflation and handling assistance device of Figures 1 and 2 and shown 5 without the stand support details;

Figure 4 is a side sectional view as seen in Figure 3 but with the hub and tire assembly shown in a tilted position bringing the tire into contact with the ground; and

10 Figure 5 is a view of an alternative hub engagement and stop structure presenting a complete upper surface.

DETAILED DESCRIPTION OF THE INVENTION

While the present invention will be described in terms of a stand alone, independently supported device and system 15 used to facilitate tire inflation and handling, the operative portion of the device can be mounted in a variety of locations and operative positions in the shop environment. The stand-alone version will facilitate a complete, unassisted deployment and complete breakdown for 20 stowage.

Referring to Figure 1, a tire inflation and handling assistance device 21 includes a base portion 23, vertical support member 25 supporting a pivotable hub engagement and stop structure 27.

25 The base portion 23 includes a main member 31

preferably constructed of structural steel, such as I beam or tubular steel. The ends of the main member 31 have short angular extensions 33 and 35. At the ends of the extensions 33 and 35 an insertion member (not shown) extends into a leg member 37 and into a leg member 39, respectively. Leg member 37 has an insertion locking threaded member 41 while leg member 39 has an insertion locking threaded member 43.

The locking threaded members 41 and 43 enable a locked assembly position shown in Figure 1, with subsequent 10 unlocking and release of the insertion members (not shown) which lie just inside the leg members 37 and 39. In the configuration shown, the detachment of the leg members 37 and 39 form two of the three main dis-assembly junctions.

Also shown in leg members 37 and 39 and main member 31 15 are bolt-down openings 45. Bolt-down openings 45 are formed by opening an aperture on the upper side of any of the leg members 37 and 39 and main member 31, with a smaller aperture on the lower side of the same members. This enables a bolt having a bolt head to be passed through the 20 bolt-down openings and through a smaller aperture on the underside of the leg members 37 and 39 and main member 31, with the bolt head to engage the lower wall of the leg members 37 and 39 and main member 31 to enable the base portion 23 of the tire inflation and handling assistance 25 device 21 to be securely floor mounted if desired.

At a point near the center of main member 31, an insertion sleeve 47 is welded lateral to the member 31 and in a vertical position. Into the insertion sleeve 47, the vertical support member 25, is supported. An insertion 5 locking threaded member 49 is provided int the insertion sleeve 47 to lock the vertical support member 25 into place.

At the top of the vertical support member 25, a bolt 51 provides pivoting support to hub engagement and stop structure 27. The hub engagement and stop structure 27 is 10 mounted to pivot toward the observer of Figure 1. A stop member 53 near the top of vertical support member 25 acts to limit the degree of tilt of hub engagement and stop structure 27 which is shown in Figure 1 in the horizontal position. The degree of tilt is from about 50 to 75 degrees 15 and more preferably from about 55 to 70 degrees from the horizontal position shown in Figure 1 to enable an uninflated hub and tire assembly (not shown) to be tilted to a position engaging the tire support member and to enable an inflated hub and tire assembly.

20 The hub engagement and stop structure 27 has four plates 57 which are mounted orthogonally together to form a minimalist structure for generally matching and permitting centering in a well space in a commercial truck tire. Other shapes for different types of tires is possible, as well as 25 a more protruding smaller center structure to more fully

extend through and engage and stabilize a tire hub.

The configuration shown includes the hub engagement and stop structure 27 being mounted to the side of the vertical support member 25, with the width of the stop member 53 5 spanning the width of both the vertical support member 25 and lower pivotal attachment portion of the hub engagement and stop structure 27. It may be preferable to have a support configuration which is centered over the vertical support member 25 for improved lateral balance distribution.

10 For commercial truck and trailer tires which may be about 38 inches in diameter, the dimensions of the tire inflation and handling assistance device 21 may include a 28 inch length for the leg members 37 & 39, and the main member 31. The insertion sleeve 47 is preferably about 7 inches in 15 length and of an internal dimension which will fit the external dimension of the vertical support member 25.

The preferred length of the vertical support member 25 is about 19 inches. Each of the plates 57 have a major dimension length of about 6.5 inches to result in a hub 20 engagement and stop structure 27 having an overall width of about 13 inches. The angled portion of the hub engagement and stop structure 27 has an angle of about 40 degrees and leaves a flat length atop each plate 57 of about two inches and a flat length at the base of the angled length of about 25 2.75 inches. The four plates 57 form a plate assembly 61

which rests above an angled plate 63. One side of the angled plate 63 is engaged by the bolt 51. The angled plate 63 has a rearwardly located stop plate 65 which steadies the pivoting hub engagement and stop structure 27 in the 5 horizontal position. The stop plate 65 and the stop member 53 set the range of tilt of the hub engagement and stop structure 27 about the axis of the bolt 51.

The height of the top of the plate assembly 61 is about 25 inches, while the height of the bolt 51 and thus the 10 pivot axis is about 19 inches. For a tire and hub assembly of about 38 inches in diameter, a tilt angle limited to about 62 degrees from horizontal, the height of the pivot should be about .88 times the radius of 19 inches or about 17 inches.

15 However, for stability, the center of the plate assembly 61 is both higher than and offset from the pivot so that the weight of the tire and hub assembly lies upwardly and to one side of the pivot axis of the bolt 51. The top of the plate assembly 61 is about 6 inches higher than the 20 pivot, but the design contemplates that the center of any tire and hub assembly will be lower than this point by about 2 to 4 inches. The only requirement is that the tilt be sufficient to have the radial edge of a tire to either touch or come closely enough to the ground to enable a user to 25 tilt the upper edge of the tire and hub assembly off of the

plate assembly 61.

As a result of this offset position, the pivoting of the plate assembly 61 provides some upward movement and upper and lateral extension of its center of gravity. The 5 offset position helps to stabilize the tire and hub assembly (not shown) in the horizontal position, an important consideration when manipulating the tire and hub assembly to enable it to seal and initiate pressured inflation.

Referring to Figure 2, a side view of the tire 10 inflation and handling assistance device 21 taken along line 2-2 is shown. The horizontal position is shown in solid line format while the tilted position is shown in dashed line format. As can be seen, a lower edge of one of the 15 four plates 57 engages the stop member 53 to limit the angular tilt of the plate assembly 61. Other structures can be used.

Figure 2 also more clearly shows the action of the stop plate 65 in providing a stable, well supported horizontal support to the angled plate 63. Other structures 20 can be used to support plate assembly 61 and other locations and types of the stop structures 65 and 53 are possible. Note that the location of the pivot axis within the bolt 51 is offset from the center of the support plate assembly 61. Even where a support, such as angled plate 62 is centered 25 with respect to the vertical support member 25 with respect

to the view seen in Figure 1, an offset along the plane of tilt will provide the stability necessary to enable workers to manipulate the tire and hub assembly to initiate pressurized inflation. In the alternative, an latch or user 5 operable lock can be used to more completely stabilize the plate assembly 61 in the horizontal position with release to the tilt position.

Also seen in Figure 2 is a polymeric or synthetic protector 69 which may be a "U" shaped and may have a bolt 10 or rivet attachment device 71. This use of a protector can help prevent scuffing of expensive hubs onto and off of the plate assembly 61. In practice, the insertion sleeve 47 can be attached to any structure in the shop which has sufficient holding force to provide support to the hub 15 engagement and stop structure 27 and the weight of the hub and tire assembly.

The insertion sleeve 47 or similar structure can be formed into a concrete floor to enable the hub engagement and stop structure 27 to be rapidly deployed and stowed. The 20 ability to eliminate the remaining stand members, including main member 31 and leg members 37 and 39 will facilitate deployment and stowage, and will eliminate the floor space disruption. In the alternative, the insertion sleeve 47 can be attached or welded to any other available structure in 25 the shop which has adequate clearance for accommodating a

tire and hub combination.

Also seen for the first time in Figure 2 is the insertion portion 73 at the ends of the short angular extensions 33 and 35. The insertion portions are preferably of reduced cross sectional dimension to both enable fit into the leg members 37 and 39 and secured by the insertion locking threaded member 49. The exterior dimensions of the short angular extensions 33 and 35 should match the exterior dimensions of the leg members 37 and 39 both to insure good fit and a flat support surface profile.

Referring to Figure 3, a hub and tire assembly 75, including hub 77 and tire 79 is seen mounted on tire inflation and handling assistance device 21 shown from the vertical support member 25 and upward and eliminating main member 31 and leg members 37 and 39, for clarity. The plate assembly 61 is seen protruding through a centered opening of hub 77. The configuration shown is one where full pressurized inflation has occurred, but this position would also be had where the tire 79 is fitting loosely within the hub 77. In this position, and with an uninflated tire 79, the hub 77 and tire 79 would form a seal along the bottom portion of the hub 77 and tire 79 with the object being the introduction of enough air mass and velocity to cause the upper inside portion of hub 77 rim 81 to seal.

Referring to Figure 4, the hub and tire assembly 75 is

seen mounted on tire inflation and handling assistance device 21 in a position where a just inflated tire 79 has been tilted to contact the ground 83. The configuration is also equivalent to one where an un-pressurized hub and tire assembly 75 has been rolled to the tire inflation and handling assistance device 21, the hub engagement and stop structure 27 being tilted to engage the open center of the hub 77 as the worker leans the hub and tire assembly 75 toward the tire inflation and handling assistance device 21.

Once the open center of hub 77 has been brought over the plate assembly 61, further pressure on the upwardly extending radial portion of hub and tire assembly 75 to cause the tilting to the configuration shown in Figure 3.

The advantages of the tire inflation and handling assistance device 21 will assist in inflation when in the position of Figure 3, and will assist in handling when brought to and taken from the configuration seen in Figure 4. The shape of the plate assembly 61 may vary along with the angle of tilt seen in Figure 4. Where the diameter of the hub and tire assembly 75, along with the pivot height of the hub engagement and stop structure 27 creates a greater tilt angle than is shown in Figure 4, it may be desired to provide a modified plate assembly 61, or even a differently shaped engagement structure for hub engagement and stop structure 27 other than plate assembly 61.

Note that the upper angled portion of the plate assembly 61 in Figure 4 is nearly, but not quite horizontal and tilts somewhat downwardly in the direction of the hub 77 to assist with loading the hub and tire assembly 75 onto the 5 plate assembly 61. This arrangement, with the geometry shown, insures easy access to the plate assembly 61 by simply tilting the hub and tire assembly 75 onto it. Where it is desired to have the hub and tire assembly 75 approach and engage a hub engagement and stop structure 27 at a 10 steeper angle, a substitute for the plate assembly 61 may include a deeper penetration through the central opening of the hub 77 than is shown in Figures 3 and 4 to insure that loading from a steeper angle will not create slippage.

Further, the hub engagement and stop structure 27 can 15 be made of a solid shape or it can have an engagement shape which is a continuous surface. The use of four, three, five or more plates 57 radiating from the center having edge engagement as is shown in Figures 3 and 4 provide stable, sturdy engagement, but the force is concentrated on the 20 areas where the edges of the plates 57 engage the hub 77 opening. The material of construction of the plates 57 should be chosen for wear resistance, and any synthetic protector 69 chosen should have a resistance to deformation consistent with the concentration of high force due to the 25 limited contact area between the intersection of an edge on

plate 57 and an edge of a circular opening of the hub 57.

Increased area can be created by increasing the thickness of the plates 57, as well as by the addition of a conical shaped covering material to distribute the contact area.

5 In fact, an extended height conical surface could provide structure which would achieve a more extended penetration as well as an extended surface area coverage. Referring to Figure 5, one such design is shown as a hub engagement and stop structure 91 and which has side angles 10 which are consistent with the upper angled edges of the plate assembly 61. The internals of the hub engagement and stop structure 91 could be of any design, or the hub engagement and stop structure 91 could be welded atop the plate assembly 61 with or without the extension of the 15 plates 57 to underlie the apex of the cone shaped upper extent of hub engagement and stop structure 91.

While the invention has been described in terms of a stable support for two position tilting of a hub and tire assembly of any size, and in particular a support which 20 facilitates vertical rolling, tilting to engage a hub engagement and stop structure, controlled further tilting to a horizontal position, pressurization, tilting back to a slanted position followed by tilting pressure to a vertical position to facilitate rolling, one of ordinary skill in the 25 art can see that the device of the invention can be applied

to many appliances and process tools. The present invention may be applied in any situation where movement from an vertical rolling position to an energy favorable horizontal position and back to a vertical rolling position is desired.

5 Although the invention has been derived with reference to particular illustrative embodiments thereof, many changes and modifications of the invention may become apparent to those skilled in the art without departing from the spirit and scope of the invention. Therefore, included within the 10 patent warranted hereon are all such changes and modifications as may reasonably and properly be included within the scope of this contribution to the art.